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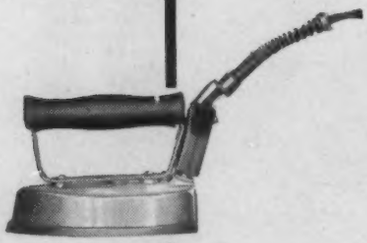

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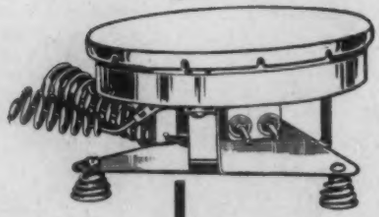

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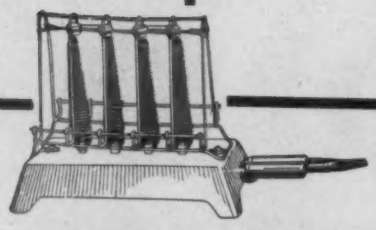

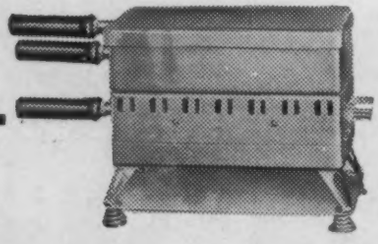

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POWER AND GAS
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PORTLAND, EUGENE & EASTERN ELECTRIFICATION

BY PAUL LEBENBAUM.

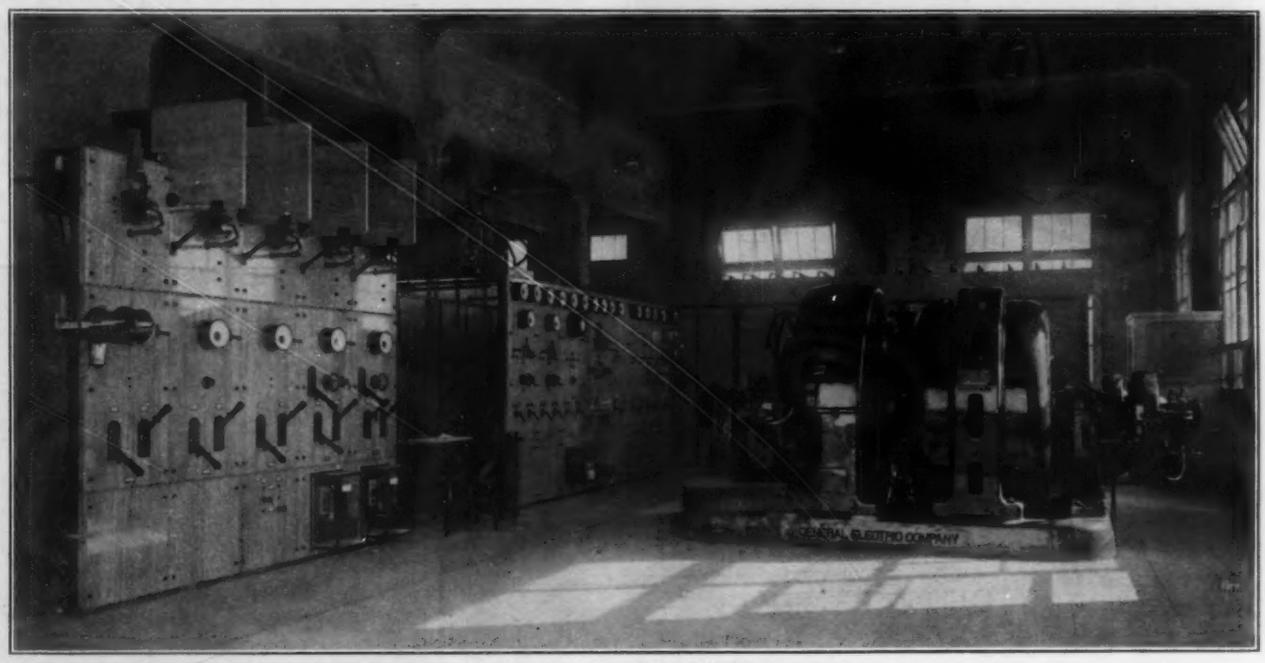
(This article covers the electrification of first unit of the Southern Pacific lines in Oregon, under the auspices of the Portland, Eugene & Eastern Railway. The distribution system is described in detail as is also the overhead construction, rail bonding, dispatching and telephone system, rolling stock, car equipment and control; also its advantages. Mr. Lebenbaum presented the paper before a joint meeting A. I. E. E. and N. E. L. A., Portland, Oregon, March, 1914.—The Editors.)

This development had its beginnings as far back as 1904, when a report was submitted covering the electrification, by means of a 2200 volt system, of a portion of the line between Portland and Forest Grove, and Portland and Oswego, with a possible extension of the latter line from Oswego to Oregon City.

The report, however, was never acted upon, so that when in 1909 a request was made for a new report, the advance in the field of electric traction since 1904, made it desirable to consider some other than the 2200 volt a.c. system.

The Southern Pacific Company having decided upon a 1200 volt system for its suburban lines around San Francisco Bay, it was but natural that the same type of system be given more consideration than any other in electrifying the company's lines out of Portland.

At the time specifications were drawn up for the substation machinery and multiple unit car equipment, manufacturers were requested to bid on 1500 volt equipment as well as on 1200 volt. The saving in feeder copper possible with a 1500 volt system as against the 1200 volt, which, for the same loads and the same percentage drop to any point is 56 per cent, caused the higher voltage to be adopted. Though no announcement was made, for reasons of policy, at the time this apparatus was purchased, it was the first manufactured for a trolley voltage of 1500, although due to unavoidable delays in construction it was not the first road to be put into operation at that voltage.

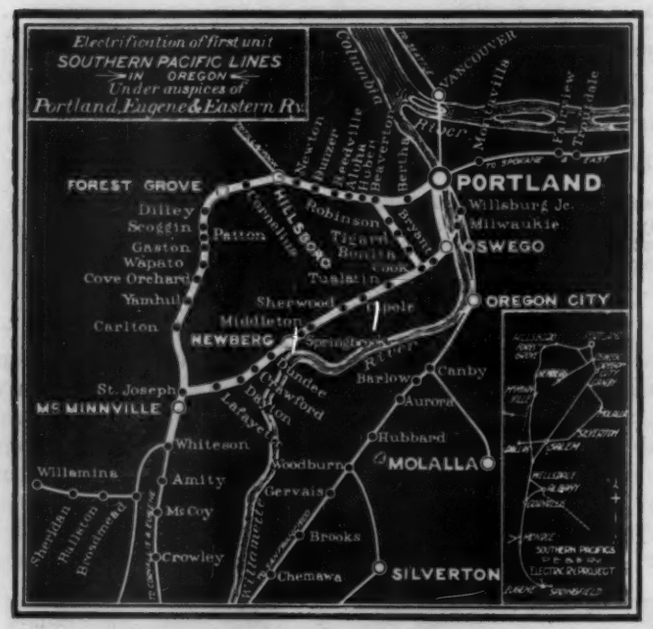


Interior Oswego Substation.

The first section of this system, recently completed and put into operation, is shown on the accompanying map.

The 1909 report covered the electrification between Portland and McMinnville of the then existing steam lines. In 1911 a comprehensive report was made by Robert E. Strahorn, now president of the Portland, Eugene & Eastern, covering a system of electric

lines in the Willamette Valley as shown on the lower corner of the map. This development covered a total of 340 miles of electrified tracks, some entirely new lines, the remainder at present under operation by steam. The company also owned and operated at that time, street car systems in Eugene, Albany and Salem, and a survey and some right of way between Eugene and Monroe, in addition to the logging road between Monroe and Corvallis.



Map of First Unit P. E. & E. System.

These Portland, Eugene & Eastern properties were acquired by the Southern Pacific Company, and the complete electrical development given this name.

The original substation locations determined upon for the first unit between Portland and Whiteson were at Bertha, the summit of the long grade west of Portland, Forest Grove and Dayton. Keeping in mind, however, the extension of the lines south from McMinnville towards Corvallis, and south from Oswego towards Salem, the logical site for a substation in the vicinity of Portland became Oswego, and on account of the necessity for a substation at McCoy, the substation proposed for Dayton was finally located at Dundee, which is some four miles nearer Oswego.

The following description applies only to the two lines running south from Portland to Whiteson, one via Forest Grove, the other via Newberg.

The physical conditions prevailing on the Loop make it possible to have all three substations feed into the larger portion of the electrified mileage—in fact, out of 105 miles of main line, 69 miles (lying east of Forest Grove and Dundee) is fed by the three substations. This is made possible by connecting the north and the south sides of the Loop from Beaverton to Cook over what is known as the Cut-Off, which permits both Dundee and Forest Grove, even if to only a small extent, to help Oswego carry the greater load that naturally exists at the main terminus of any railroad. In order to furnish the train ascending the long grade out of Portland on the Forest Grove line more directly with energy than by feeding all the way from Oswego to Portland via the East side (or Newberg) line and then back over the West side (or Forest Grove) line, a tie line, consisting of both positive and negative feeders, was built from a point on the East side line three miles nearer Oswego, to a point on the West side line, which is close to the summit of the grade, the length of the tie line being 2200 ft.

Energy Supply and Distribution.

Energy at 55,000 volts and 60 cycles is supplied to the system under a contract with the Portland Railway, Light & Power Company, who deliver it at Milwaukee to the railway company's transmission line. This line, 2¼ miles long, is built on the railway company's right of way from Milwaukee to Oswego, using standard 60,000 volt construction, with pole spacing of 150 ft. It crosses the Willamette River on special supports attached to the side of the railway bridge just north of Oswego; at the entrance to Oswego substation, there is a horizontal double break pole top, disconnecting switch, operated from the ground by a lever that is normally locked. It enters the substation through roof bushings, a tap being taken in the line just ahead of the bushings, to the horn gap switch for the lightning arresters, this switch being mounted on an iron framework on the roof of the substation.

In deciding what the voltage of the transmission lines should be, the question of the type of machines to be installed in the stations was a determining factor. On account of the 60 cycle supply synchronous motor generator sets had to be used.

It must be remembered that the conversion apparatus for these substations was purchased in 1911, at which time there was no idea of the possible use of 60 cycle, 1500 volt, rotary converters.

It being perfectly feasible to build the motors for any voltage up to 13,200, two alternatives were presented; one to transmit at 55,000 volts to each substation, and install transformers to step down to 2300 volts for the motors (this giving a machine somewhat lower in first cost than a 13,200 volt motor); the other to combine all transformer capacity in one substation

Crossing of Oregon Electric and Portland, Eugene & Eastern, Showing 60,000 and 13,200 Volt Transmission Lines and 1200 and 1500 Volt d.c. Trolley Line.

(Oswego), where on account of the larger diversity factor existing between the various substations, transformers of an appreciably smaller total rated capacity could be installed, 13,200 volt motors could be used in all substations, and transmission could be at 13,200 volts to the other two substations for application directly to the motors.

Balancing the lower cost of motors and transmission line copper plus the transformers required in three substations if 55,000 volts were used, against the higher cost of motors and copper plus the transformers in only one substation if 13,200 volts were used, it was found that the latter would be most economical.

The 13,200 volt line from Oswego to Forest Grove is 26 miles long, and from Oswego to Dundee is 22 miles long. The line is carried at the top of the poles supporting the catenary trolley construction, is of No. 1/0 copper and the three wires are placed in a horizontal plane on the cross arm. Malleable iron insulator pins, cemented into the insulators and held to the cross arm by a ¾ in. bolt, are used. The lines terminate on pole top disconnecting switches just outside of each substation.

Substation Equipment.

Oswego substation, besides containing the motor generator sets, together with their switchboards and switching devices, that are common to all three substations, has installed in it the transformers that serve the loop lines. There are two, each of 1000 kw. capacity, three-phase, primary voltage 55,000, secondary voltage 13,200, with taps on both primary and secondary. They are connected star on both high and low sides, this being permissible on account of the balanced character of the load.

Transformers are oil insulated and water cooled, one transformer only being required to handle the entire load of the system. On the high side they are protected by 60,000 volt disconnecting switches and three-pole automatic electrically controlled oil switches. These oil switches are of the Baum type, extensively used in California on some of the larger systems and have a horizontal break, two breaks in series per pole. On the low side they are directly connected to the 13,200 volt distributing bus by means of automatic oil switches and knife disconnecting switches. From this distributing bus are taken the lines that feed the different substations. Outgoing 13,200 volt lines are protected at the substation by means of electrolytic lightning arresters. Both 60,000 volt and 13,200 volt electrolytic lightning arresters are of the four-cell type, one cell being placed in the ground connection.

A short description of Forest Grove substation will cover also the means taken in Oswego and Dundee substations to transform from 13,200 volts a.c. to 1500 volts d.c.

The incoming transmission line is equipped with electrolytic lightning arresters, horn gaps and automatic switch. All oil switches are electrically controlled, current being obtained from either a small 4½ amp. storage battery (8 hr. rating) or the exciters of the synchronous motors. These latter are started at half voltage from an auto-transformer, the starting and running switches of each set being electrically and mechanically interlocked so that only one can be thrown at a time.

The motor generator sets, of which there are two at each station, consist of a 560 kw., 13,200 volt, three-phase Y connected, synchronous motor, with a speed of 720 r.p.m., direct connected to a 500 kw., 1500 volt, d.c. compound wound, generator. An 8 kw., 125 volt exciter is mounted on the shaft. The set has two bearings. The a.c. switchboard consists of an incoming line panel, two motor control panels, and a battery and lighting panel. All apparatus thereon is standard The d.c. switchboard has two generator and two feeder panels. The breakers and switches, being 1500 volts, are remote mechanical control, the operating handles passing through to the back of the board. The circuit breakers are mounted at the top and front of the panels, and the main switches at the rear of the board on a separate slate base.

The generator breakers are equipped with reverse current relays and no-voltage release. The trolley is sectionalized in front of each substation, each section being fed by individual feeders from the 1500 volt station bus.

The auxiliary equipment in each substation, besides the battery, consists of a 5 kw., 13,200/120 volt transformer for supplying the light and power circuits, and a small motor driven air compressor for cleaning.

Exterior Dundee Substation.

The substation buildings at Forest Grove and Dundee are 60 ft. long by 40 ft. wide and are of reinforced concrete throughout. The Oswego building is 62 ft. long and 62 ft. wide and is divided longitudinally into a transformer section and a conversion section each 31 ft. wide. The transformer section consists of two floors, the upper containing the 60,000 volt busses, switches, lightning arresters and metering transformers and the lightning arresters for the 13,200 volt outgoing feeders. The ground floor contains the two 1000 kw. lowering transformers, each of which is set in a separate fireproof compartment. A Kinnear rolling door is provided for the front of each compartment; transformers rest on rails and for repairs may be slid on to a four-wheel truck that runs on a depressed track serving both compartments. Space is provided for a third transformer this space being at present occupied by oil storage tanks and an oil filtering and drying outfit. The tanks, drier and transformers are so piped that oil can be removed

from either transformer, filtered or dried, and pumped back without interfering with the operation of the transformers.

All 13,200 volt wiring, disconnecting and oil switches and current and potential transformers are in bus compartments, the phases of each circuit being separated from one another by barriers of transite and the various circuits by concrete barriers. This construction gives an efficient but inexpensive bus structure.

Single Track Curve Construction With 13,200 Volt Transmission Lines.

Double Track Overhead Construction With 13,200 Volt Transmission Lines.

Overhead Construction.

The details of the material used in the construction of the overhead, feeder and trolley system were developed by the Southern Pacific Company on its lines on the east side of San Francisco Bay, some slight modifications being made to meet local conditions.

The standard pole spacing on tangents, and curves up to 2 degrees, is 150 ft.; on curves from 2 to 4 deg., 120 ft.; on curves from 4 to 6 deg., 90 ft.; and on all curves over 6 deg., 60 ft. On future construction these spacings, on account of a new method used in pulling off curves, will be so modified as to eliminate the 60 ft. spans. In arriving at the proper tension at which to string the messenger wire, due consideration was given to the ice and sleet loads that might obtain, and under maximum load conditions, the tension in the messenger does not exceed the elastric limit. The wire was strung in the field at a tension of 2200 lb. at 70 deg. F. On the standard 150 ft. span, the distance between trolley and messenger is 24 in. at the bracket, and 6½ in. at the center of the span. Hangers are spaced 15 ft.

The standard bracket arm consists of two 2½ x2x5/16 in. angles, attached to each side of the pole, brought together at the outer end, and supported by a 5/8 in. bracket rod. All line material is galvanized. The feeder is carried on a plate attached to the bracket arm and is 336,534 c.m. aluminum, or the equivalent of No. 4/0 copper. Mechanical sleeves of the McIntyre type are used to splice the feeder. Taps are made by means of a two bolt aluminum clamp, that takes both the feeder and a No. 4/0 copper cable, the latter being then soldered into a standard 7 in., 4 screw, feeder trolley ear.

All poles are cedar with 9 in. tops, and are set 8 ft. from face of pole to center line of track. Where transmission lines are carried on trolley poles, these are 45 ft. long and set seven feet in the ground; otherwise poles are 40 ft. long and set 6 ft. 6 in. in the ground. All poles are given two thorough brush treatments with an approved preservative from a point 18 in. above the ground to within three feet of the butt. The preservative is applied by means of burlap fastened to the ends of long mop handles, and is kept hot by steam coils placed in the bottom of the shallow tank over which the poles are rolled.

The total mileage of electrified tracks is about 105, exclusive of sidings, spurs and yard tracks.

Rail Bonding.

All rails are single bonded with the American Steel & Wire Company's pin expanded bonds, of No. 4/0 capacity. Both the flexible and ribbon type bonds are used, the first on 75 lb. S. P. standard tee-rail, and the latter on 90 lb. A. R. A. rail.

Of the total main line mileage, there are 40 miles of 90 lb. rail and 65 miles of 75 lb. rail. All rails are provided with joint plates designed to give sufficient clearance for the bonds.

Telephone System.

Train dispatching is handled by means of telephones, a selector system being used. The selector is an electro-mechanical device whereby the electrical circuit of any one of a number of bells, connected across the telephone lines, is controlled from the dispatcher's office at Portland, without affecting any of the other bells connected across the same line.

The selector in each station is set to respond to certain electrical impulses, the proper combination of currents being accomplished by an individual calling key, consisting of a simple train of gears, operating a circuit breaker, somewhat similar to the familiar district messenger call box. One such calling device, or key, is provided at the dispatcher's office for every station on the line.

The train dispatcher is assured of the call being received at the station, as he receives what is termed an answer back signal from the station bell itself, this being a very distinctive click that lasts as long as the bell rings.

Selectors in each station are placed directly across the line, the current for operating selectors being obtained from a central battery located at Portland.

In addition to selectors in all stations where agents are situated, mine sets have been installed along the line at all other points where there are spurs or sidings, but no station facilities. These mine sets are connected directly across the telephone line, and enable train crews to call the dispatcher for orders. These mine sets are enclosed in weatherproof iron boxes, and are generally placed in the shelter sheds adjacent to the spur.

In addition to the telephone line used for train dispatching, there is a circuit that connects all the substations, construction and maintenance headquarters, the train dispatcher, shops and the electrical engineer's office in Portland. The selectors on this power circuit, as it is called, are operated by means of an intercommunicating key, whereby any station can call any other station, without having to work through a central office.

The dispatching circuit consists of No. 9 B. & S. hard drawn copper wire, and the "power" circuit of No. 9 B. & S. copper clad wire.

Cars and Equipment.

The rolling stock equipment for the electrified lines consists of seventeen combination passenger and baggage cars, thirteen motor coaches, eleven control, or trailer coaches, and five baggage and express cars. In addition to the above, there are now under order three mail, baggage and express cars. This gives a total of 49 cars, of which thirty-eight are motors.

Car bodies were built at the Chicago plant of the Pullman Company and the trucks at the Baldwin Locomotive Works.

The three types of passenger cars are of the same general design, and are of steel construction throughout, except for the interior finish; the headlining and wainscoting are agasote, and the window sash, mouldings, battens and frieze panels are mahogany.

All cars are 56 ft. 10 in. long over buffers and 9 ft. 2 in. wide over sills. The motor and control coaches seat 60 people, and the combination passenger and baggage cars 52. Motor cars weigh approximately 50 tons, completely equipped and ready for service; control cars weigh 33 tons.

The electrical equipment is of the multiple unit type, consisting of four GE-205-B motors, and the necessary motor and control apparatus. The gear ratio is 54 to 20, giving a speed of approximately 50 m.p.h. on level, tangent track. The equipment is designed to operate at full speed on 600 volts, as well as on 1500 volts, the motors being in series and series multiple on the high voltage and in series multiple and multiple on the lower voltage.

Current is collected with a pantograph, the collector proper being two feet long and five inches in diameter. The collector had cone bearings when received, but owing to bearing wear on long runs the company is developing a roller bearing.

In single car operation the pantograph is raised and lowered by air, but in operating with more than one motor car the pantographs are controlled electropneumatically so that all pantographs can be raised or lowered at the will of the motorman. Each car is equipped with a hand air pump for raising its pantograph before the air is pumped up by the compressor.

While the first cost of the device is much more than the trolley pole and wheel, its cost of maintenance is about one-third per 1000 car miles.

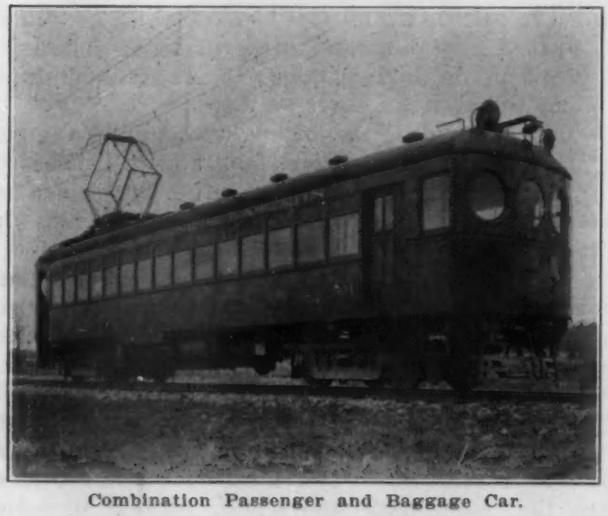
There are no unusual features in the motor circuits. Fifteen contactors are used to make the resistance combinations, which are the same for either fifteen hundred or six hundred volts. The resistance connections for both voltages are made through the commutating switch.

The circuit breaker is especially designed so as to permit of double the current setting on 600 volts as on 1500 volts, this being accomplished by a graduated tripping spring while on 1500 volts, and a magnet coil while on 600 volts. The magnet coil is energized through contacts on the commutating switch which make on 600 and are open on 1500.

There are a number of other devices in the control circuit that may be of interest in that they are features that have been worked out so that the cars will change automatically when passing from 600 to 1500 volts after the commutating switch on the leading car has been thrown to the desired position by the motorman from his cab, which he does by means of a valve switch.

By means of a specially designed potential relay it is impossible to throw the commutating switch while the pantograph is on a live trolley wire. The relay has three sets of interlocks. Two sets are in circuit with the wires that operate the commutating switch and one set in circuit with the No. 2, or holding wire, in the control circuit. The relay is energized whenever the pantograph is on the trolley and opens the interlocks on the control wires to the commutating switch, closing the interlocks on the No. 2 wire. As soon as a dead section is reached by the pantograph the relay drops out, the interlocks on the commutating switch control wires make contact, and the commutating switches can then be thrown automatically as each car passes the change over or dead section from 600 to 1500 or vice versa. This is brought about

by the motorman throwing the valve switch above mentioned to the desired position on the head car, which throws the commutating switch on the first car by air direct; commutating switches on the following cars then throw electro pneumatically. It is necessary to hold the valve switch handle in position until all cars are across. It is necessary when throwing the switch on the leading car or single car to



Combination Passenger and Baggage Car.

have the controller in the off position, as the practice is to change over head car just before getting on the dead section. It is not practicable to change over to 1500 volt position on 600 volt trolley as the dynamotors that furnish light, control current and air will not generate enough voltage to pick up contactors in this combination.

The dynamotor has a double wound armature, the 1500 volt winding motoring the compressor, and generating on the 600 volt end current for lighting and control. On 600 volt the 600 volt end motors the compressor and the 1500 volt end remains neutral. This is accomplished by special connections and changes made when the commutating switch is thrown. The dynamotor has a permanent resistance of 18 ohms between it and the trolley connection in the 1500 volt position.

The air compressor is operated by means of a clutch which is engaged and disengaged by air pressure. The air pressure is governed by an electric magnet valve which is operated from a type "J" Westinghouse air governor; the speed of the dynamotor is constant, whether pumping or not.

When passing on to a dead section, in order to prevent flashing and burning up of section insulators, a time limit potential relay has been provided and by means of brushes placed at either end of dead sections and auxiliary contacts on the pantograph frame which are just ahead of the roller the relay is picked up, causing all line contactors to drop out. The relay is fitted with a dash pot that prevents its dropping back quickly. A selector relay is provided, which prevents 1500 volt trolley current from passing into the 600 volt circuits. A by-pass relay is also provided for stepping up by hand control and getting off a resistance point when the current through the current limit relay is excessive and will not allow the latter to drop and automatically step out the resistance points.

The air brakes on the cars are Westinghouse universal type; as the name implies, any type of air brake can be used in connection with it without changing air piping, as all piping runs to a pipe bracket, to which bracket the parts of the universal valve are bolted. The following are a few of the salient features of the equipment.

It is automatic in action;

It gives maximum protection against complete loss of the brakes due to failure of any part of the system;

It has a quick recharge feature;

Full emergency pressure is applied automatically when a predetermined brake pipe reduction is made after equalization.

Quick action is obtained automatically when brake pipe pressure is depleted below a predetermined danger point due to leakage or any other cause.

There is also a rather important feature in connection with the brakes; a car cannot be moved until the air pressure is pumped up so as to cut in an automatic control switch and complete the control circuit of the contactors.

Capitalization of water rights by water companies is legal and may be included in estimating the total investment in connection with rate-making. This is the substance of a decision of the Supreme Court of the United States which reversed Judge Morrow in the San Joaquin & Kings River C. & I. Co. vs. Stanislaus County case. An article on this important case is in course of preparation by A. E. Chandler and will be published in an early issue of this Journal, as well as on a case recently handed down by the California Supreme Court entitled Del Mar Water, Light & Power Company vs. Eshelmann, et al This latter case deals with water right contracts and the right of water company to restrict its territory and its consumers. The supreme court holds that it may do so, thus reversing the California Railroad Commission, which had held to the contrary.

In the great Palace of Machinery at the P. P. I. E., will be assembled exhibits of machinery used in the generation, transmission and utilization of power. The several groups will comprise examples of steam generators and motors; internal combustion engines; hydraulic engines; miscellaneous motors; general machinery and accessories; and tools for shaping wood and metals. To these will be added ten special electrical groups covering the generation, distribution and control of electrical energy in its application to mechanical and motor power, lighting, and heating. Special effort will be made to classify and display the exhibits of machinery so that they will have educational value to the public as well as to afford comparative interest and profit to inventors, machinists and manufacturers. The increasing use of electrical apparatus in the industries, vocations and affairs of life caused the management of the exposition to abandon the use of a separate building for electricity and distribute the machinery and apparatus throughout the palaces according to its use in the various industries.

PROGRESS IN TRANSMISSION LINE CONSTRUCTION.

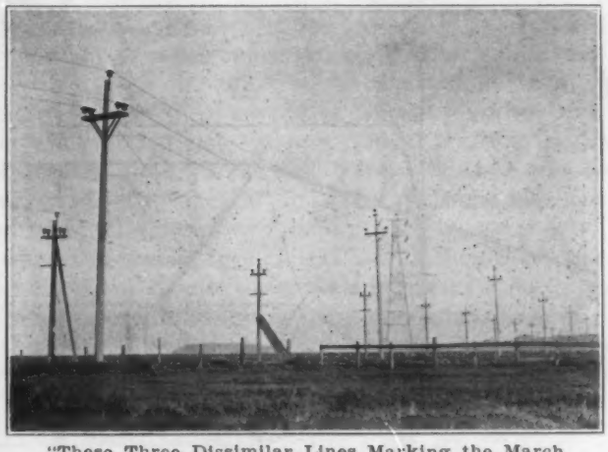
BY A. S. KALENBORN.

(In this article the author describes the construction and characteristics of three parallel transmission lines which, constructed at different periods, indicate in an interesting manner the development of transmission line practice.—The Editors.)

A very interesting exposition of the progress that has been made in the construction of high tension transmission lines is to be seen on the peninsula just south of San Francisco.

Three parallel, high tension lines skirt the bay shore at a short distance eastward from the Southern Pacific Railroad line down through the peninsula towns of San Bruno, Millbrae and Burlingame,

Two of these lines are 60,000 volt construction on wooden poles belonging to the Pacific Gas & Electric Company and the third is a 100,000 volt steel tower line of the Sierra and San Francisco Power Company.



"These Three Dissimilar Lines Marking the March of Development."

The accompanying half-tone shows the three lines as they appear from the car windows.

The closely spaced poles are those of the old Standard Electric Company and are square sawn redwood 35 ft. poles spaced 40 per mile.

This line was built around the bay in January of 1901, so the line is now thirteen years old. (E. W. Vol. 39, p. 25). This was one of the pioneer lines in long distance transmission and was the end of a 142 mile line. A composite insulator was used, a porcelain top cemented onto a glass center, which type was soon replaced in the bay region by the larger, all porcelain four part insulator.

Push posts were used at angles instead of guys, on account of there being "no guy line insulator developed to stand 60,000 volts."

The triangle was 36 and 42 in. and frequent transpositions were made in the line wires.

For double construction at the pole top two large wooden brackets were bolted to the poles so as to separate the insulators far enough for requisite clearance.

The eucalyptus pins were inserted in holes, bored into the pole top or into the brackets.

This was one of the first lines on which aluminum was used as a conductor. A 37 strand 471,034 c.m. cable being strung which is still in place.

The poles in the marshes are still in good condition but in the San Joaquin Valley a considerable number have been "stubbed" on account of the poles rotting at the ground line.

The second pole line was built in December, 1905, when the Martin Station of the Pacific Gas & Electric Company was being put into service.

These poles are 50 ft. round cedar spaced 20 per mile, the triangle is a 72 in. one, the insulators four part 14 in. porcelain, and the wire aluminum strand of 350,000 c.m.

Near San Bruno an odd looking pole extension can be seen on some of the old "Standard" poles which increases the height sufficiently to offset the increased sag due to the removal of every intermediate pole.

This extension or pole top can be seen also on the "Bay Lines" of the Pacific Gas & Electric Company near Suisun. The reason for this peculiar construction is not at once apparent. When the "Bay Lines" were being reinstated with four part 14 in. insulators in 1905 there were but two large insulator factories in the United States and the job of turning out seventeen thousand insulators along with their booked orders represented about two years' work for them. We therefore halved the required number of new insulators by lengthening alternate poles and taking out the others as fast as the new insulators were in place.

The result was a saving of one-half the time for the completion of the job, half the cost of insulators, and the salvage of nearly 2000 poles. The cost of the pipe extension was about offset by the value of the reclaimed poles.

To return to the three lines:

The steel tower line shown was built in 1909.

The towers of Aermotor manufacture, two circuit, are 50 ft. high to the lowest arm and 67 ft. to the top. The spacing is 850 ft. or 6.2 per mile.

The conductor is No. 00 six strand, hemp center copper cable.

The insulators are Locke 14 in., five in a string and the circuits are transposed every three miles.

The minimum clearance at span centers is about the same for the three lines as can be seen from the cut.

On all heavy angles the line wires are dead ended on strings of insulators.

All three lines give entire satisfaction, the old pioneer pathfinder, the standard or usual type of wood pole line as now being built and the modern durable steel tower line.

Side by side through pleasant weather and through stormy seasons these three dissimilar lines marking the march of development, transmit the hydroelectric power from the mountains to the western metropolis of the Golden Gate.

The electric furnace for smelting iron was not developed as a competitor of the blast furnace, but for the purpose of finding a furnace and process that would enable the production of iron in localities where blast-furnace practice was not feasible, or where the increasing cost of suitable fuel was becoming prohibitive to existing smelting practices.

ELECTRICAL TESTING

RESISTANCE OF STATOR WINDINGS OF INDUCTION MOTORS.

BY ALFRED STILL.

It is well known that the performance of a poly-phase induction motor may be predetermined with a reasonable degree of accuracy by constructing the Heyland circle diagram from easily obtained test data. The measurements required are:

(1) The current and true power per phase of stator winding when the machine is running light at normal voltage and frequency.

(2) The current, volts, and true power per phase with shaft clamped to prevent rotation, and rotor short circuited.

(3) The resistance, per phase, of the stator winding.

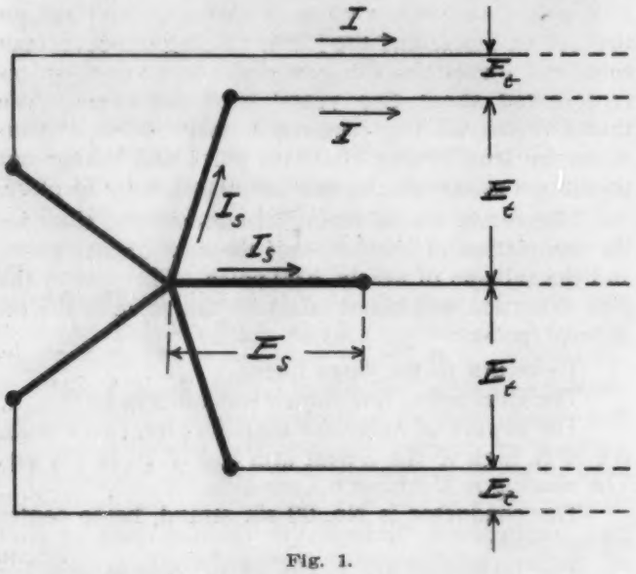


Fig. 1.

In connection with this last measurement, the statement in books treating of poly-phase machines is usually to the effect that the most convenient method of determining the resistance is to pass a known continuous current through the windings, and observe the drop of potential. This statement seems simple and clear until such time as the reader attempts to carry out instructions. He then finds difficulties in his path, especially if the stator is mesh connected. In but one case has the present writer seen a clear statement as to the method of procedure in making this test on a three-phase motor when the method of connection (whether star or delta) is unknown. This occurs on page 285 of Mr. C. F. Smith's book on alternating current testing. (Practical Alternating Currents and Alternating Current Testing. The Scientific Publishing Company, Manchester, England.)

The following notes have reference to the general case of a poly-phase induction motor wound for any number of phases.

If the stator windings are star connected, as in Fig. 1, the resistance per phase, whatever the number of phases, is $R_s = \frac{1}{2} R_t$ where R_t is the resistance as measured between any two terminals. The potential drop per phase is $\frac{IR_t}{2}$ and the total copper loss in stator winding is $\frac{1}{2} nI^2R_t$ where I stands for the line current (in this case the same as the current I_s in the windings), and n is the number of phases.

In the case of a mesh connected winding, the solution is not so simple. It is desired to find an "equivalent" resistance R_s which, when multiplied by the square of the line current, will give the watts lost per phase. In Fig. 2, the heavy lines represent the windings of a mesh connected stator. The vector construction shows that the current in the windings is

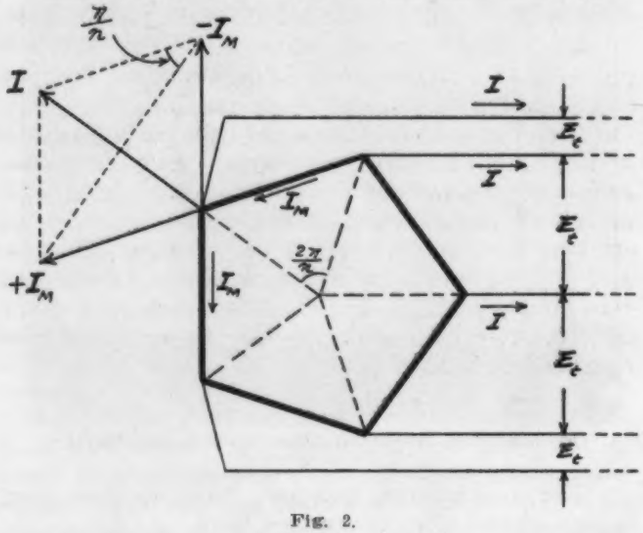


Fig. 2.

$$I_m = \frac{I}{2 \sin \frac{\pi}{n}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The copper loss per phase of the stator winding is therefore $\frac{I^2}{4 \sin^2 \frac{\pi}{n}} \times R_m$ where R_m is the resistance per phase of the mesh connected winding. Let R_t be the resistance as measured between adjacent terminals; then, since there is one path of resistance R_m in parallel with another path of resistance $(n-1) R_m$ it follows that

$$R_m = \frac{n}{(n-1)} R_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The "equivalent" star resistance, R_s, can be obtained from the equation

$$R_s I^2 = R_m I_m^2$$

$$\text{or } R_s I^2 = \frac{I^2}{4 \sin^2 \frac{\pi}{n}} \times \frac{n}{(n-1)} R_t$$

whence $R_s = \left(\frac{n}{4(n-1)\sin^2\frac{\pi}{n}}\right) R_t$ .....(3)

$= k R_t$

Values of k for different numbers of phases are given in the following table:

No. of Phases.	Factor k.
n = 3	1/2
n = 4	2/3
n = 6	6/5
n = 12	4.07

The total copper loss in the stator of a mesh connected winding is $k n I^2 R_t$ while, in the case of a star connected winding, it is $\frac{1}{2} n I^2 R_t$ as previously mentioned. Thus, when k has the value ½, the resistance as measured between terminals will serve to determine the watts lost in the stator windings whether these are star or mesh connected. This value of the factor k corresponds to the three-phase windings, and leads to the simple rule that the equivalent star resistance, R_s, per phase, is one-half of the resistance R_t as measured between terminals, whether the stator is provided with a star or a delta winding. For any larger number of phases, it is necessary to know how the stator is wound. If any difficulty is experienced in tracing through the windings, a simple test will suffice to show whether the stator is star or mesh connected. The resistance between terminals 1 and 2, and also between terminals 1 and 3 should be measured. If the results differ, this indicates a mesh connection, and the formula (3) or the values of k in the table must be used in calculating the equivalent star resistance per phase.

ELECTRIC SMELTING AND REFINING.

Broadly speaking, it may be stated that the feasibility of smelting iron ores in an electric furnace depends upon the relative cost of either charcoal or coke and of electric power. As regards the latter, it must be cheap.

In those electric-furnace iron plants that are operating at the present time only hydroelectric power is used. The cost of producing power for electric-furnace work must, of course, vary with local conditions, and hence depends upon the initial cost per kilowatt of installation. In general, there are few localities where the electric smelting of iron ores would be feasible with the electrical energy costing more than $20 to $30 per kilowatt year.

The cost of making steel in the electric furnace also varies with local conditions. The cost of power does not enter so largely into the final cost as it does in some other electrometallurgical processes, especially the refining of molten steel. Plants are operating successfully under a power cost of 1 cent per kw.-hr. in localities where material can be obtained at the price common to other processes. Plants such as the one at Ugine, France, have been established in remote localities, where the cost of power is very low, 0.2 cent per kw.-hr., but the cost of material is high.

For many years all high-grade steels were manufactured by the crucible process, but since the advent of the electric furnace there has been a gradual adoption of that furnace for refining steel. For the complete refining of the highest grades of steel the use of the electric furnace is now thoroughly established in Europe. Any product that can be made by the crucible process can be made by the electric furnace, and in most cases with cheaper raw materials and at a lower cost. In the electric furnace complex alloy steels can be made with precision. The high temperatures attainable facilitate the reactions, and alloys need not be used so largely for the purpose of removing gas. Very low carbon steels can be kept fluid at the high temperatures. Steels free from impurities and of great value for electrical apparatus can be made. With the electric furnace large castings can be made from one furnace, whereas in the crucible process steel from several crucibles must be used. For small castings, which require a very high-grade metal, free from slags and oxides, electrically refined steel is especially adapted. The electric furnace gives a metal of low or high carbon content as desired, hot enough to pour into thin molds, and still free from slags and gases.

There is now a tendency among consumers of rail and structural steel to require a higher-grade steel at an increased price, rather than steel of acid Bessemer or even of basic open-hearth grade at a lower price. With the high cost of power that now prevails throughout the steel centers of the United States, the electric furnace can not compete profitably with either the acid Bessemer or the basic open-hearth process in manufacturing steel of like grade from pig iron. It is in combination with either of these processes that the electric furnace seems destined to be prominent in steel manufacture. The cost of super-refining in the electric furnace the molten steel from either of these processes, exclusive of the cost of molten steel, varies from $1.50 to $2.25 per ton, depending on the cost of power and the impurities to be removed.

The above information is abstracted from Bulletin 67, "Electric Furnaces for Making Iron and Steel," just issued by the Bureau of Mines. The investigations into electric furnaces for making iron and therein reported, were made by Dorsey A. Lyon, and into electric furnaces for making steel by Robert M. Keeney. The bulletin gives a historical review of the development of electric furnaces for making iron and steel, and discusses the problems which remain to be solved in the use of electric furnaces for the smelting of iron ores and the production of pig iron at a profit and on a commercial scale.

The second part of the report presents a brief historical review of the development of the electric furnace in the manufacture of steel up to the present time. Mr. Keeney describes in detail the types of electric furnaces in commercial operation for the manufacture of steel, and, in general, types which have not yet attained wide use. He gives a description of the practice of the European and American electric-furnace steel plants and compares in a general way the different types of furnaces and the more established methods of steel manufacture with the electric furnace process.

LIGHTING METHODS

LIGHTING FOR PROFIT.

BY H. E. GRANT.

(In this paper, which was presented before a recent meeting of the Alameda County Electrical Development League at Oakland, Cal., the author outlines some of those factors to be considered in lighting for profit and emphasizes the value of active membership in the Illuminating Engineering Society to that end.—The Editors.)

Success in business hinges upon securing profitable customers.

In business no man laboreth for himself alone. Even the so-called "independent" in business for himself, is working for others.

If he is successful; secures profitable customers; profitable, that is, with reference to his cost of doing business; then his accounts too may be paid.

Every man who secures customers is himself, in turn, a customer.

He buys labor. And with his wages, the man who sells his labor pays his own bills, to grocer, butcher, baker and so forth.

He buys material. And the jobber is paid and in turn pays the manufacturer. So the results of his effort may be traced in ever widening circles.

The effort of the individual in business is communal.

For this reason the community has a right to insist that business methods shall be adopted by those who engage in trade.

Yet it is true—criminally so—that the average man is sinfully lax in keeping accounts. Bookkeeping is too often considered an unnecessary burden, and has but a nodding acquaintanceship with this average man.

It is small wonder that so many tradesmen go under. The main difficulty is, however, that "no man striveth to himself alone." The loss must be paid by someone, and generally it falls upon your stable, well-founded tradesman, and in turn upon his customers, and so on.

State laws should be more strict regarding the conduct of business, for the elimination of failures would tend largely to reduce the high cost of living.

Systematic bookkeeping is essential to success in business.

Systematic bookkeeping does not show merely the liabilities and assets, but also the cost of doing business.

Few know what this item really is, and one has only to glance at the enormous difference in the figures of competitive bids to know that such systematic book-keeping is lacking.

So far then, we have two suggestions. First, the securing, which might also include the creating or development of business, and second, proper cost accounting and bookkeeping. On both these matters your society might do well to appoint committees, so that the interests of individual members and all, would be furthered.

A word regarding the securing of business. There are two wrong methods followed. By monopoly uncontrolled, and in the hands of the unscrupulous, and through unfair competition. The first mentioned is not pertinent to this discussion, whereas the last certainly is.

You and I and all of us are interested in fair competition, and are only too glad on any fine day to down tools in order to go to the ball game.

Each side is well matched, and we watch the game with interest. But one side only can win, and competition is keen. Then, looking for an opening, one manager takes an unfair advantage. We detect it, and immediately a howl of protest and condemnation arises. The man and his team are despised.

Why can not this same spirit which insists on equal opportunity in competition for all be carried into our business world?

It is commonplace that this is not done. Some newspapers will "give" away electric appliances as premiums with subscriptions—these appliances are really sold at cost—or the central station, not being dependent on this business, and desirous of securing customers, will wire your house or fill your lamp and appliance requirements at cost, sometimes free of charge; and again within your own camp, wiring contractors, in order to get the business on their own end will supply the lighting fixtures at cost.

None of this is legitimate business. Carried to an absurd extreme, everbody would get everything at cost, and there would be no business, for all would do nothing but "give."

Before we go into this discussion further, let us state the position:

We have electrical manufacturers and jobbers, which two classes can be eliminated as not pertinent to our subject except in that they produce efficiently and distribute in a like manner.

Then we have the dealer who is often a wiring contractor, and the fixture dealer.

Sometimes, as is the case in outlying districts, all three functions are carried out by one individual or firm, this being an economic necessity and under such conditions, representing the essence of good service.

No one objects to any man engaging in any business he pleases. It is imperative though that he conduct his business on business lines, and not transact one class of business at a loss in order to boost his other classes of business, and so beat his competitors.

To any extent to which he does this he indulges in unfair competition—takes an unfair advantage, is a combination in restraint of trade, and should be dealt with as such.

What is needed, is a code of business ethics not only adopted, but lived.

For example, where there is a difference in overhead expense between two classes of business, this should be taken into consideration. The wiring contractor should allow, if he must sell fixtures, a suffi-

cient margin of profit on that item, otherwise he forces the fixture dealer to become a wiring contractor and perhaps in this way, forces himself out.

When we consider the little fellow, the man without overhead of any kind—the screwdriver electrician—we are on treacherous ground.

No one is desirous of eliminating him, but here again the plea must be made for fair competition. All must live.

The difficulty is in his case, that he usually figures incorrectly, like the old apple woman, who, buying twenty-four apples at two for one cent, and the same number at three for one cent, wondered why she lost money at selling them at five for two cents. If he would but conduct his business on a proper basis, with proper reference to others, he would be as welcome to try for business as any man.

Every one must at some time make a start, and usually as one of the little fellows.

There is room for the little fellow in another sense too.

The coming of the carbon filament lamp placed then in the category of things past, the incandescent metal filament lamp. The many inventors and manufacturers of these could see no possible way of competing in the open market with this new carbonized thread lamp which could be produced so cheaply.

It was left to a later age to demonstrate that the American people want quality, not cheapness, as is evidenced by the popularity of the present day Mazda lamp, which has forced its cheap competitor off the market.

Quality is found to be the handmaid of economy. The most expensive things found to be the least expensive.

It is the province of your well established fixture and electrical dealers, to demonstrate this fact, and their efforts, in self-preservation, are towards this end. It is therefore disappointing when the little fellow, not appreciating this need for quality sales to quality purchasers for quality installations, comes along with something just as good at a considerable saving, and so makes an unsatisfactory installation which, in turn, reacts upon the trade.

The point to which your attention is particularly directed is that the little fellow should keep to his small jobs until such time as he can handle the bigger jobs with that understanding which is essential to the exacting of a fair profit.

Figuring for profit is a subject worthy your fullest discussion.

There is a reciprocal tendency on the part of the bigger fellows to crowd out the little ones.

Sometimes the big man's eyes, like those of the horse, magnify the little fellow out of all proportion to his actual competitive importance. For the present, especially if they will be so satisfied, they should at least be allowed the crumbs which fall from the rich man's table. If in some distant future one or more may become prosperous and actual competitors, surely they at this time but contribute to the real prosperity of bigger business.

Let the little fellows pick up the smaller jobs and cheaper. As they do this they achieve their measure of success, keep the floors of business clean, and leave open for larger endeavor—the quality contracts—the energies of bigger business.

Remember, that in bending to compete with weaker rivals, prices are sometimes lowered all round, and occasionally beyond the possibility of being again raised to normal. This creates a condition which adds risk and causes all to work much harder for less gain.

We thus include another factor in our discussion, which is the placing of boundaries to endeavor.

Practically everything which might be offered as solving such difficulties and of assuring the greatest good to the greatest number revolves around the pivotal point of education further enlightened by mutual understanding and agreement.

Your league is to be complimented on the excellent direction of your effort toward that end.

As fixture dealers, wiring contractors, and so forth, you are as individuals and collectively, specialists. Probably you may think that at league meetings insufficient attention is given to the problems of your own craft.

Here perhaps is the solution.

Specialization calls for co-operation, and co-operative effort completes the cycle by pointing to the necessity for co-operation.

Your Electrical Contractors' Association, Fixture Dealers' Association, Section of the American Institute of Electrical Engineers, or National Electrical Light Association, are all essential.

Probably these different associations may have varying periods which require a frequency changer, in order to bring all into harmony.

Such is the value of the joint meeting under a management of diversified though associated interests, and so may your league be both arbiter and harmonizer.

As individuals you cannot belong to too many associations, provided that they return to you either directly or indirectly the equivalent of your dues—with interest being always preferred.

But of all resources, at the present time engaging attention, perhaps the most important is the conservation of cash. Careful expenditure and wise investment obtain everywhere. Wise investment is now more necessary than in the past, and is made wherever profit will result. Those expenses which are useless have already reached the vanishing point.

It is but a short time since electrical men everywhere were only too eager as suggested, to join every engineering or other association launched in connection with the industry. We were, what Elbert Hubbard would call, "A Brotherhood of Joiners." Now we carefully analyze the derivable benefits before the dotted line of the membership application is ornamented with our autograph. A high standard of worth is the measure of desirability.

Membership in the Illuminating Engineering Society is worthy your consideration, but this leads us naturally to the question—"What is the business impulse back of the Illuminating Engineering Society which makes membership desirable?"

It is because the whole trend of the work of this Society has been toward the more general use of light-

ing and the improvement of lighting methods. This has meant wonderfully increased business in the past and may mean a much greater increase in the future.

The aim of the Illuminating Engineering Society has been to educate the general public as to what constitutes the best in lighting methods as well as to evolve the science and improve the art. In this way, not only are the comparatively small number of lighting installations which come under the supervision of the professional engineer much improved, but there is also a general improvement in the standard of the multitudinous smaller installations. This means increased business.

Extensive as the work has been in the past, it needs but a walk along a business thoroughfare or a round of residence calls to show that the principles and advantages of the employment of proper lighting methods has not yet penetrated deeply into the minds of the public.

Ability to direct the improvement of these poor lighting conditions constitutes opportunity.

Other things being equal then they have most opportunity who possess the most useful knowledge along the line of their endeavor, for opportunity will crowd you if you are prepared.

Competition is now so keen in securing lighting business both from the viewpoint of the central station, electrical contractor, fixture dealer, jobber and glassware manufacturers' salesmen, that their selling has become a science.

A prospective customer is a continual expense until his business is secured and along these lines you will find that the business gravitates toward the man with the most knowledge—the one who can give most, even if it is only information.

If time permitted, other arguments might be advanced as to why jobbers, central station, fixture, and lamp salesmen, engineers and manufacturers, should join the Illuminating Engineering Society.

Speaking generally, lighting in the past has been poorly done, and again, that which from the viewpoint of those days was par excellence, is, with our wider knowledge, and invention with its improved equipment, now obsolete. In both cases the lighting systems shoull be replaced, and would be in the majority of cases if someone would but show exactly how it should be done, and give the proof of its greater effectiveness and economy. New lighting installations will be planned by and awarded to the man who knows how, especially in view of the introduction of lamps having a still higher efficiency than the present day Mazda lamps.

Legislation in lighting will be needed and it is essential that it be properly directed and not haphazard as has been the case with headlight and other laws framed by legislators without the aid of expert knowledge.

You should be in a position to supply that knowledge backed up by the weight and authority of the collective effort of your league.

Knowledge of lighting methods for business purposes and to protect yourselves from unfair legislation, is an immediate future need.

A California section of the Illuminating Engineering Society should be formed.

Furthermore, the Illuminating Engineering Society enables you to bring the architect into your counsels, for he too is vitally interested in this important subject of lighting.

You need the architect with you in the interests of improved, and hence more profitable business.

Specifically an architect is one whose profession it is to devise the plans and ornamentation of buildings and to direct their construction. Ruskin's conception of a great architect is—that he "must be a great sculptor or painter." The intricate and diverse engineering problems which enter into the construction of the modern building but interest him in a general way. They are the problems to be solved by specialists—heating, ventilating, structural, electrical, or whatever the case may be.

But it is so easy to mark locations of lighting outlets on plans, and the actual problems are so obscured or unknown, that the placing of the illuminating engineering of buildings into the care of an expert, that the best lighting methods be used, has been the last of the real engineering problems to be reluctantly surrendered by the architect.

But the necessity for the proper planning of lighting installations is everywhere in evidence.

The architect although having surrendered this work must still have a good general knowledge of this science of illuminating engineering.

The architect is the creator who rules over the destiny of the building. Its ultimate evolution into one complete and harmonious whole is within his control.

It is therefore essential that he know positively, just how the work of the illuminating engineer will fit into his decorations, and the fixture manufacturer's design harmonize also—the proper light and shade effect being secured in all parts of the interior. He is the final court of appeal, and when the seal of his approval has been placed upon the work of the several specialists, it must be because the work of all harmonize, that it is in a word, satisfactory.

Information invaluable to the architect would therefore be conveyed through the medium of the Illuminating Engineering Society meetings and discussions.

We need the co-operation of the architect. In the electrical industry we need the architect moving among us as one with us, and if the Illuminating Engineering Society accomplishes this much to be desired end alone, and it certainly opens the way, then it is worthy your support.

We have caroomed pretty well all over and around this subject of lighting for profit, but it is to be hoped that each, from somewhere will extract something of individual benefit.

Lighting for profit is largely a matter of education of the public, but principally of ourselves. There must obtain mutuality and a common cause. Where this does exist, and the success of the industry as a whole is uppermost, individual successes follow as surely as the current flows wherever a conductor for it is supplied.

Provide that conductor and prevent the commercial suicide of the least of us, or all.

UTILITIES AS AN INVESTMENT.

BY LOUIS GUENTHER.

(This short article summarizes and reviews the showing made by some of the leading public service corporations during 1913, as indicating the growth, magnitude and soundness of this form of investment. The author is editor of the Financial World.—The Editors.)

Based upon the annual reports of earnings furnished The Financial World for the Fifth Annual Public Service Corporation Review by 286 of the leading companies for the fiscal year 1913, and which appear in that number, the showing made should prove gratifying to those interested in this field of enterprise.

The tabulated aggregated earnings reflect a healthful and normal increase in gross and net earnings, despite the fact that in other avenues of enterprise it has proven difficult to maintain earnings and profits up to a point where they would indicate no shrinkages as compared with the former year's business.

Gross earnings of these 286 companies for the year were $866,416,400, or $54,857,676 greater than a year ago. The percentage of increase was 6.76 per cent; net earnings were $370,801,186, a gain of $19,492,267, or 5.55 per cent; and surplus after all allowances for fixed charges and dividends, was $81,113,567, a gain of $2,655,893, or 3.54 per cent.

During the year these 286 companies disbursed to investors in interest on bonds, including all other charges, $150,223,407, which was $10,787,446, or 7.73 per cent, more than a year ago, and in dividends there was paid $130,777,354, which amount was $5,881,041 greater than in 1912, or a gain of 4.72 per cent.

From the above tabulation it is apparent that the public service corporations in every respect have forged ahead both in gross and net revenues and in the profits and interest they have been able to divide with those whose capital has made their financing possible and successful. While the surplus over all charges and dividends shows a smaller ratio of increase, this is due to the fact that during the year the 286 companies increased their bonded debt by $87,820,793, the charges on which absorbed profits and cut into the surplus account.

This increased indebtedness was incurred principally for improvements and extensions which have not yet had an opportunity to develop additional traffic and revenues, but when they get fairly into play they are expected to add proportionately to the revenues of the companies.

What should attract the most marked attention is the vast amount of capital invested in this class of enterprises and which can be taken as a reliable indicia of the prominent position these companies occupy in the development of our country.

Our statistics indicate that the 286 companies have outstanding $2,151,842,261 in bonds. This is $87,820,793 more than in 1912; a total of preferred stock of $592,007,950, which is $18,821,721 greater, and common stock of $2,216,766,418, or an increase of $38,392,053.

Here is a total investment in these public service corporation enterprises, covering gas, electric light and power, telephone and telegraph and street railway, as well as interurban transportation corporations, of over $4,900,000,000.

No stronger proof could be asked for or furnished to support the argument that, next to the steam railroads, the greatest volume of capital has flowed into public service enterprises. The fact that the business has steadily developed into larger proportions with each year has shown the wisdom of this form of investment.

Of all industries none has evidenced a better ability to withstand adversity than public service enterprises.

The new transisthmian transmission line on the west side of the railroad, between Gatun and Cristobal, has, in part, been placed in service, in substitution for the former 6600 volt transmission line between the steam generating station on the west side of Gatun Locks and the transformer substation at Cristobal. The current is generated at 2200 volts and stepped-up, through transformers, to 6600 volts for transmission. At the present Cristobal station it is reduced to 2200 volts for primary distribution, the various local circuits receiving it through a smaller pole-line type of transformers, which step the pressure down to 220, or 110 volts, as desired.

A special gas burner for foundry use, built by Superintendent Flanders of the Everett Gas Company, promises to be of great benefit to the foundries and to increase the loads of gas companies in the Northwest. All foundries in that section of the country ignite coke in a cupola with a wood fire at the base. This requires the time of one man to split the wood and make kindling for the purpose. It also takes an hour to light the coke before the air blast can be turned on. By using a gas burner with high pressure air, the cupola is filled with coke and ore, the special gas burner inserted in the "take-off hole," and the coke is fully ignited within 25 min., the gas burner consuming approximately 1000 ft. of gas per hour. It is believed that this burner will make it desirable for the foundries to use a considerable quantity of gas.

Scientific management substitutes theory, which is the accumulated and systematized experience of many, for empiricism, which is the more or less shrewd guess-work of the experienced individual. As applied to manufacturing it has five organic functions: (1) Design (originates), (2) Equipment (provides conditions), (3) Control (specifies duties and gives orders), (4) Comparison (measures records and compares), (5) Operation (makes). Each of these functions are regulated by the three laws of effort: (1) Experience must be systematically accumulated and applied, (2) Effort must be divided, co-ordinated, conserved and remunerated, (3) Personal effectiveness must be promoted. Wherever a duty has a justification for existing it must be for the purpose of serving one of the five functions and is subject to the laws of effort.—A Hamilton Church in "Greater Efficiency."

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POWER AND GAS

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ERRATA NOTICE.

In the table showing relation of velocity to head on p. 352 in Geo. J. Henry's article on "Water Conduits" in the issue of March 25, the first 3 values for h should be placed at the end of the column.

Popularity Pandering

None will dispute the educational value of the popular press, but all will view with regret its bending with the bender to remove, if possible, the private utility corporation, as such, and to place in its stead the "service" of questionable economic advantage rendered by public ownership.

Only that which can, and ought to be, transmitted to writing should be published by any periodical. Accuracy is the prime essential.

But popular magazines, in their endeavor to cater to the passing fancy sometimes ignore this and create artificial conditions calculated only to hold interest until the magazine is sold. This results in the founding of the fictitious and the expression of the fanciful and fleeting.

And because these magazines are what they are, the reader is often lost in that zone of intellects' unfolding twilight where fact is separated from fiction; but it is a light too, in which one is unfortunately often mistaken for the other, and a lie takes on the semblance of truth.

The summation of the whole matter is, that popularity pandering creates the appeal only and not the proof. It is an invitation to investigate further.

* * * * * * * *

A recent popular magazine article states that "Nothing is more characteristic of our privately owned railroads than their wrecks which are part of the sins the roads cannot hide from us." It mentions the existence of "secret sins which the railroads do hide," and then refers to the creation of desert wastes into forest reserves and Indian reservations in the interests of the railroads, and a mulcting by them of the people's millions.

This is advanced as one of the arguments in favor of public ownership.

Railroad companies have had their peculiar and important problems of rapid growth and expansion, of finance and legislation, yet with all this they have found time to devote a lot of attention to the question of safety—first, last and all the time.

It is true that there have been exceptions but the prominence given these when accidents have occurred or irregularities have been discovered, merely emphasizes the rule of the railroad's considerateness of its patrons—the traveling public.

Safety with the railroads is an economic necessity, and consideration of the fact that our railroads handle, in the rendering of a desired standard of service—comfort and high speed—the heaviest rapidly moving machinery known, the accidents which do occur are comparatively few.

The railroad companies are rapidly adopting newly invented devices for the protection of life and their effort in this direction is meeting with an appreciable reduction in the number of accidents.

In this connection reference may be made to the Southern Pacific Company and its remarkable record, referred to in a previous editorial. The article in this

issue by Mr. Lebenbaum goes to at once show the sane conservatism, yet progressiveness of the company in its desire to protect its passengers.

In such sweeping statements as that made in the popular magazine article referred to, this company is also included and this is certainly not just. It labels the article superficial and untrue.

And, incidentally, that government officialdom and manipulation had parted in land values with millions of the people's money without expectation of return, seems an absurd argument to advance in favor of public ownership.

Have you any assurance that administration of other public properties—railroads, telephone, telegraph, electric light, power and gas plants—by the government, would be more free from manipulation and such enormous public loss?

* * * * * * *

Yet there are some utility corporations who push the sale of popular magazines with their menace of publicity pandering and false education and who fail to see their need for supporting those trade periodicals and technical journals which at least analyze these matters conscientiously and speak of things as they are.

Effectiveness

Efficiency is but a conservation which makes effectiveness possible. Effectiveness embraces efficiency but the efficient is not necessarily effective. The efficiency of a lamp, for example, may be but one factor in the effectiveness of the illumination, and similarly the efficiency of the reflector is dependent upon its proper installation with reference to the lamp, and of the complete unit to the work to be accomplished. Successful accomplishment, results count, and the real measure of worth is found to be effectiveness.

The most efficient lamp is one burning at a voltage most conducive to its operating value and without any auxiliary equipment, but it is not effective.

As with lighting so with individuals—efficiency without effectiveness is loss. So you have the seemingly absurd situation of ineffective efficiency.

In the illustration given the lamp was most efficient, that is with regard to maximum output, or performance, but because so much of the lighting or work done was in unnecessary places, the lamp was inefficient; an efficient lamp inefficient because not effective.

To be competent; to go into the minutest detail; to have all the ability, reliability and power necessary, is alone not enough though to possess these is to be efficient. An efficient is a qualified person, but qualification without intelligent application—knowledge without right use—is of no value.

It is maximum effectiveness which is most desirable in all things.

Suspended above a dining-room table the bare lamp would be undesirable, but equipped with a dome or indirect bowl and it would be at once pleasing and although less efficient, of more value because effective. The light has been concentrated, controlled, and put to a right use.

With individual endeavor the results are again similar. There is a seeming loss while the concentrating and gathering together of resources is in process, and to the near-sighted control is also a loss; but the broader view shows that the candle cannot be burned at both ends or allowed to dissipate its energy in all directions.

Such light, though it uncovers the detail of the darkest corner does not accomplish the most complete service because so much of the energy expended in this form of lighting is wasted.

Concentration, control and right use are essential.

So, with the thought implied, the word "effective" is proposed for your consideration in place of that overworked word "efficiency," as a further step toward realization of the principle which the advocates of efficiency have purposed to convey.

Why not aim at effectiveness—results?

Specialties and Staples

It is a simple matter to sell staples, specialties and new lines in the territory sold need more strenuous endeavor. In the first case, the market is established, and through advertising, the goods almost sell themselves, irrespective of who gets the business, while in the latter case the market has to be created in this case the business being almost invariably secured by the creator of the market.

But staples are the foundation of business continuity and are essential, though it is inadvisable to get into a business rut. The problem is, how best to appreciate the business in staples and yet not get into a rut. A rut has been described as "a grave, only longer."

To air another aphorism: Hard times are for those who think hard times.

For the business man who would think hard at times, the story is different.

The great value of invention to business is that it proves an equalizer of the market, lowering the business peaks of impossible accomplishment and filling the valleys of business depression with the new.

Inventors rely upon the artists for the commercialization of their ideas and the artists depend in turn upon the workers for the carrying out of their projects.

Invention benefits all.

The situation may be compared to the play. The play's the thing of the inventor's mind; the stage setting and production the work of artist manager, and the actors the actual workers.

The suggestion for distributors, dealers and contractors contained in the foregoing is: When times are "hard," concentrate on specialties and the new, and when business is good, turn to staples—the "new" things which have established themselves.

New devices, new lamps, new fittings and fixtures, are continually displayed for the improvement of the gas and electrical businesses. And the only logical advice is: Do not wait for the specialties to become staples, but use them while novel in the interests of increased business and improved service, and so fill up the valleys of business depression.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. O. Presbey, representative of the Holophane Company, is at Salt Lake City.

G. R. Gillespie of the Gillespie Mine Company, Sierra City, Cal., was a San Francisco visitor last week.

J. A. Ulmer of the Ulmer Machinery Company, Porterville, Cal., was a recent visitor at San Francisco.

F. F. Skeel, salesmanager of the Crouse-Hinds Company, Chicago, Ill., spent a few days at Seattle last week.

Lester I. Brown has been appointed secretary of the Bloomfield Mutual Telephone Company, Bloomfield, Montana.

L. F. Youdall of the Electric Equipment & Machine Company, Stockton, Cal., was at San Francisco during the past week.

L. A. Somers of the industrial and power department, Westinghouse Electric & Manufacturing Company, is at Stockton, Cal.

George R. Cooley, electrical engineer of the firm of Buxbaum & Cooley, has been elected a member of the city council of Seattle to fill a recent vacancy.

D. Havey, formerly city salesman Electric Appliance Company, has left on his initial trip through the Nevada territory to which he has been transferred.

H. B. Vanzwoll, of the Sunbeam Lamp Works of the General Electric Company, is at Seattle from Salt Lake City, and will visit other cities on the Pacific Coast.

Robert E. Strahorn, president of the Portland, Eugene & Eastern Railroad, has returned to Portland, Ore., from an extended trip through California, Nevada and Utah.

J. H. Parker of the J. H. Parker Company, Chelsea, Mass., is visiting Pacific Coast cities in the interests of Eastern porcelain manufacturers and the electric insulator business.

H. L. Parker of The Emerson Electric Manufacturing Company, St. Louis, Mo., stopped off at San Francisco for a few days on his way East from a trip made to the Hawaiian Islands.

Walter W. Brown, until recently city specialty salesman, with the Electric Appliance Company, resigned in order to engage in business at Modesto, Cal., with the Industrial Service Company.

F. D. Fagan, sales manager, San Francisco office Edison Lamp Warks of General Electric Company, is at the Merritt Hospital, Oakland, Cal., making rapid recovery from a recent operation.

E. C. Gaumnitz, purchasing agent of the Puget Sound Traction, Light & Power Company of Seattle, has resigned and has been succeeded by **F. H. Hamilton,** formerly traffic agent for the company.

H. F. Yost, formerly traveling representative of the Electric Appliance Company in Nevada, has severed his connection with the company and is opening an up-to-date electrical store at Sacramento.

W. A. Moser of the Utah office of the Westinghouse Electric & Manufacturing Company, has gone back to the factory at Pittsburg for a two months' stay on some special work for his company.

T. E. Collins of the Westinghouse Electric & Manufacturing Company, was at Fresno and attended the funeral of **W. N. Peart** of the San Joaquin Light & Power Company, who was drowned on March 28, 1914, but whose body was not discovered until last week.

J. H. Moseley, formerly with the advertising department of this journal and recently of the appliance department of the Pacific Gas & Electric Company, has decided to remain in the East and has accepted a position with the Texas Light & Power Company, Dallas, Tex.

W. F. Durand, professor of mechanical engineering at Stanford University; **J. D. Galloway** and **F. G. Baum,** consulting engineers at San Francisco, have been appointed as a board of hydroelectric engineers to advise on plans for the first electric power development in the Hetch-Hetchy water supply system.

Tsunesada Samukawa, consulting electrical engineer at Tokyo, Japan, is making a study of hydroelectric conditions in America. During the past week he visited several of the California plants in company with **Tamotsu Hirota,** with Mitsui & Co. From California Mr. Samukawa will proceed to New York by way of Keokuk, returning to the Pacific Coast by the northern route.

H. D. Curran, of the Curran Electric Sign Company of Spokane, Washington, was a Salt Lake City visitor last week. Mr. Curran has recently made a complete tour of the East, inspecting all of the sign manufacturers and signs of importance, looking for ideas to put into his work in Spokane.

J. A. Briggs Jr., consulting engineer, room 228 Laughlin Building, Los Angeles, Cal., has been elected a member of the American Society of Civil Engineers. Other recently elected western members are: **F. F. Hall,** 25 Hillside Court, Berkeley, Cal.; **Ray Emerson Koon,** hydraulic and sanitary engineer, Portland, Oregon, and **James Bond Pope,** assistant engineer, Southern Pacific Company, Flood Building, San Francisco. The following have been elected associate members of the society; **P. H. Albright,** consulting engineer, 334 Consolidated Realty Building, Los Angeles, Cal.; **Harold Conkling,** assistant engineer U. S. Reclamation Service, Boise, Idaho, and **T. D. B. Groner,** assistant engineer Oregon Short Line, Salt Lake City, Utah.

J. W. Finch has resigned as commercial agent with The Southern Sierras Power Company at Riverside, Cal., to contract on engineering construction. He has already secured the contract for the 33,000 volt transmission line from the main line of The Southern Sierras Power Company on the Mojave Desert, through the towns of Victorville and Oro Grande. Another important contract which Mr. Finch has closed and upon which active work will be commenced immediately, is a 55,000 volt transmission line, extending from Banning, Cal., to El Centro, Cal., for the Coachella Valley Ice & Electric Company, which company serves current for the Imperial Valley. This line is to be 131 miles in length, and when connected to the lines of The Southern Sierras Power Company will form the southern leg of the longest distributing power line in the world. The distance from the extreme northern terminus at Wonder, Nev., to El Centro is 586 miles.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The league met at the usual place last week, the after luncheon period being in charge of the Jovians. The coming rejuvenation, postponed from May to June 15th, was enthusiastically discussed and plans furthered assuring its success. W. S. Berry presided.

Seattle Engineers' Club.

The Seattle Engineers' Club met at luncheon at the College Club, Thursday, April 30th. W. G. Swart, president of the Western Association of Metallurgists and Chemists, who is at Seattle on a short visit, gave an interesting talk about mining conditions in the West as he has recently observed them.

Pacific Association of Scientific Societies.

Pacific Association of Scientific Societies will hold its fourth annual meeting at Seattle, May 21-23, 1914, both dates inclusive. Headquarters for the meetings will be at the University of Washington. The association includes the Geological Society of the Pacific Coast, H. B. Torrey, Reed College, Portland, and the Puget Sound Section of the American

Chemical Society, R. W. Clough, 4145 Arcade building, Seattle, and many other societies having headquarters in California.

Los Angeles Section, A. I. E. E.

The regular monthly meeting of the section, held at Blanchard Hall, on April 28th, was well attended. A lecture was delivered by Julian Adams of the Pacific Electric Railways on "Railway Substation Operation," which we shall publish in a subsequent issue. The discussion was participated in by Messrs. Northmore, Woodbury, MacDonald, Lynch, Nye, Loewenthal, Sorensen, Barrett, Miller, Dennett, Rogan and Cox. A report on the Pacific Coast convention to be held next September was read and it was decided that the Los Angeles Section present one paper at that convention.

The Jovian Electrical League of Southern California.

The weekly luncheon was held at Christopher's, Los Angeles, April 29th. City Superintendent of Schools J. H. Francis gave an after luncheon talk on "Education and Life." He made it clear to his hearers that education, to be really helpful, should be living, not only getting ready to live and that in order to insure this, education should be hitched to life itself. He described many of the educational innovations in the Los Angeles public schools, such as the new commercial course for store employes, in co-operation with the store owners; the giving of school credits for work done by pupils at home, such as cooking, music and gardening and thus linking the school to the home. He enumerated the following essentials as the most important ones in the training of our youth. Preserve the health, teach the relative value of getting and giving and instill the importance of staying power, character and a purpose in life. An interesting musical program was rendered by the recently organized Jovian quartette, consisting of Messrs. Young, Searle, Rand and Darrow. Carl C. Young was chairman of the day. A resolution was passed favoring the school bond issue, which will be voted for on May 14th.

Utah Electric Club.

At the regular meeting of the Utah Electric Club, Thursday, April 30th, C. D. Kipp presided in the absence of the regular chairman, C. C. Pratt, who was out of the city. President Torrence explained that the Electric Club had been invited by the Commercial Club of Salt Lake City to participate in a "Whirlwind Campaign" on that day, which has for its object the raising of a $40,000 publicity fund for Salt Lake City, to be expended during 1914. Ten of the principal clubs of the city had been invited to co-operate in this campaign, each agreeing to put in the field at least six teams of two men each. The Electric Club had responded heartily to the call of President Torrence for assistance, and seven teams were out working that had consisted of the following men:

H. F. Holland and W. D. Bowerman,
F. H. Barber and H. T. Plumb.
C. B. Hawley and B. W. Mendenhall.
Lloyd Garrison and F. C. Reinhart.
C. D. Kipp and R. S. Folland.
A. E. Smith and F. Rouston.
W. W. Torrence and Leo Brandenburger.

The committees had been at work all of that morning and were meeting with excellent results. It was freely predicted that the Electric Club would head the list of all of the ten clubs in the number and amount of subscriptions secured. When the final results of the day's work were checked up, however, it proved that the Ad Club had been assigned the banks of the city and had received one large contribution from all of the banks through the Clearing House Association, which threw the Electric Club into second place in the amount of subscriptions. They led by a large majority, however, in the number of subscriptions secured.

The speaker of the day was Lieutenant Cake of the U. S. Navy, who took as his subject the armament and electrical equipment of a battleship, and the part which electricity plays in its control and operation. Lieutenant Cake knows a battleship from stem to gudgeon, and explained the prominent part which electricity plays in the loading, aiming and firing of guns, the operation of turrets, ammunition hoists, signals and lighting, heating, cooking and ventilating. Lieutenant Wallace of the U. S. Army is scheduled as the speaker for next week and the senator engineers of the University of Utah have been invited to attend the luncheon as guests of the club.

IDAHO PUBLIC UTILITIES COMMISSION.

The Washington Water Power Company was granted a certificate of public convenience and necessity for the construction and maintenance of transmission lines on all the roads of Latah county, Idaho, with the right to furnish all the residents with electricity. The company, during construction of its lines and until the same are finally completed, is required to keep account of all expenditures made and immediately after the completion of the line to file with the commission the account and a report on the construction.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has arranged with the Pacific Telephone & Telegraph Company for the installation in apartment houses of individual telephone service. The matter came to the attention of the commission on the complaint of J. W. White of No. 1030 Post street, San Francisco, who represented that he was limited to service through the apartment house system.

The commission has rendered a decision authorizing the transfer of the plant and distributing system of the Sunnyvale Water Company, operating in Sunnyvale, Santa Clara county, to the town of Sunnyvale for the sum of $16,039.67. The figure is the original cost without deduction for depreciation.

The Sierra Madre Water Company, having its principal place of business at the city of Sierra Madre, Los Angeles county, has filed an application with the commission for authority to sell its system to the city of Sierra Madre for the sum of $96,000.

The commission has rendered a decision in which it finds that the rates charged and collected by the California Natural Gas Company at Bakersfield are unjust and unreasonable, the commission finding that a reasonable rate to be charged by the California Natural Gas Company to the Bakersfield Gas & Electric Company, which is the distributing concern, is $.1275 per 1000 cu. ft. on a 4 oz. basis. The commission also orders that the company shall collect a rate of $.07 per 100 cu. ft. on a 4 oz. basis for all excess natural gas, which is not used by domestic consumers, but is delivered to the Bakersfield Gas & Electric Company for the purposes of the steam plant of the San Joaquin Light & Power Corporation.

NEW CATALOGUES.

Full electric fan details are given in a booklet recently issued by the Sprague Works of General Electric Company.

D. & W. Fuse Company, Providence, R. I., has just issued Circular 150 dealing with Oil Fuse Cutouts for high tension work.

The Exide Charging Systems for Garages is fully described in a booklet now being distributed by The Electric Storage Battery Company, Philadelphia, Pa.

The new nitrogen filled lamp is described in Bulletin No. 43600 of the Edison Lamp Works of General Electric Company. Modern lighting practice in the clothing industry is fully detailed in Bulletin No. 43401 of the same company.

The Lighting of Woodworking Plants is the title of Bulletin No. 43400 just issued by the Edison Lamp Works of General Electric Company. Bulletin No. 43402 of the same company deals with the lighting of machine shops and metal-working plants.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

HAZARDS DUE TO STRAY ELECTRIC CURRENTS.

By the Secretary.

A force, properly controlled, may be of great commercial value; but, when not controlled, may prove destructive. The same quality of the electric current which is the basis of electro-chemistry and which is largely used in electro-metallurgy has, (as stray currents) caused disastrous gas explosions and has weakened the structure of underground piping; the latter a serious fault, especially where high pressure water systems are used for fire fighting purposes. Stray currents may also cause arcing between gas and water pipes in buildings. The following facts regarding electrolysis are well established. An electric current, where the circuit is completed through liquid from metal terminals, will cause the positive terminal to decompose; will cause the attacking agencies in the liquid to flow against the direction of the current to the positive terminal; may disintegrate iron in continuously wet earth at the rate of 100 lb. per year for a current of 6 amp.

Electric currents for street railway systems leave the generators to the overhead trolley wires, thence through the mechanism of the car to the rails and are presumed to return through the rails to the generator; but rails do not always offer ample conductivity for a free passage of the return current. Rail bonds may be defective; sufficient copper to reinforce the conductivity of the rails may not have been provided, and some of the current will then find a better passage through the earth and particularly through underground piping systems. Water and gas pipes offer a good avenue for these return currents; maybe the path for many amperes at a potential considerably above that of the surrounding earth. The danger lies in the fact that the current must leave the pipes to return to the generators.

At the point where the current leaves the metal pipes, through the earth, and "jumps" to other piping systems, or back to the rails, or to any point to which it is positive, corrosion occurs, due to electrolysis. This action will weaken or destroy the structure of the pipe in proportion to the current which flows and with respect to the conducting medium. Stray currents may enter buildings through one system of piping and return through another, or one system may be changed to a potential above and arc to other piping with which it is in contact, but not electrically bonded, during vibration.

The remedy is the use of sufficient copper to reinforce the conductivity of the rails so that the extreme difference in potential between the grounded terminal and any point in the return circuit shall not exceed a reasonable voltage, and that a suitable path of copper be provided for current to "leave" the pipes.

It may be well to mention here that the National Electric Code permits the grounding of low-potential (complete metallic) circuits only when such circuits are so arranged that under normal conditions of service there will be no appreciable passage of current over the ground wire. These wires may be attached to piping systems in the full confidence that the integrity of such piping systems will not be in any way affected no matter what the normal voltage may be.

TRADE NOTES.

The wiring of the new Carnegie Library at Renton, Wash., was recently let to the Wahlgren Electric Company of Everett, Wash.

The Electro-Alkaline Company, Oakland, Cal., has signed contracts for the entire output of its new plant which has just been completed.

The wiring of the Jaffe Building, at the corner of Second and Madison streets, Seattle, was let this week to NePage-McKenny & Company.

H. W. Johns-Manville Company, New York and Seattle, has been awarded the lighting contract for the new terminal station at Spokane, Wash.

The Independent Electric Company has been awarded the contract for the electrical wiring of the warehouse now being erected by the Continental Oil Company.

The San Francisco office of the U. S. Forest Service has moved to the Adam Grant Building, 114 Sansome street, corner of Bush. The change was made on account of the need for increased space.

At a special meeting of the commission of public docks at Portland, Ore., the General Electric Company was awarded the contract for furnishing power equipment on Municipal Dock No. 1, the bid being $2598.15.

The C. B. Lumber & Shingle Company of Everett, Wash., recently placed an order with the General Electric Company of Seattle, for a 312 kw. engine driven generator complete with switchboard and 350 h.p. motor.

The Western Electric Company has secured an order for 120,000 lb. of telephone cable from the Kitsap County Telephone & Telegraph Company, and the Angeles Telephone & Telegraph Company, Seattle, Washington.

The generator being installed by S. S. Bullis at Medford, Ore., is a G. E. 800 kw., and the waterwheel which is being supplied through Geo. J. Henry, hydraulic engineer, San Francisco, operates under about 750 ft. head.

The American District Steam Company is to entertain the delegates of the Sixth Annual Convention of the National District Heating Association, which is to be held at the Seneca Hotel, Rochester, N. Y., May 25-29, both dates inclusive. The special entertainment will consist of a visit to the company's plant, sight-seeing at Niagara Falls, and a dinner at the Cliftonville Hotel on the Canadian side.

The general offices of The United States Light & Heating Company at 30 Church street, New York City, will be moved on May 20, 1914, and located thereafter at the company's plant, Niagara Falls, New York. Ths transfer will result in bringing together the administrative, sales, engineering and production departments and will insure the most effective conduct of all in the interests alike of patrons and stockholders.

BOOK REVIEWS.

Legal Requirements for Overhead Construction in California; interpreted by J. E. Macdonald; 12 p.p.; size 5x7 in. Published by the Technical Publishing Company, and for sale by the Technical Book Shop, Rialto Building, San Francisco, Price 10 cents.

The text and complete diagrams are for the guidance of those interested in the construction and maintenance of the various California electrical distribution systems. It is not claimed that this pamphlet contains all that is implied in the statute (Chapter 499, Cal. 1911), but it is an analysis and brief exposition of what many engineers have agreed to be its intent and purpose. As such it should be in the hands of all interested.

INDUSTRIAL

NEW FIXTURES FOR NEW LAMPS.

A number of new fixtures adapted for use with the Type "C" Mazda lamp have been placed upon the market by the Benjamin Electric Manufacturing Company of Chicago, and these are illustrated herewith.

Fig. 1 shows a form with shallow bowl reflector and surmounting hood of enameled steel. Fig. 2 illustrates an enclosed form with 12 x 8 in. Alabaster globe. For outdoor service a copper holder and hood finished in black, oxidized copper is furnished; for indoor service brushed brass holder and hood. This globe is particularly adapted for Type "C" lamps in that it has the proper density to secure a minimum absorption of light without allowing the lamp filament to become visible. The method of hooding protects the lamp against rain and snow. Ample ventilation is provided. The fixture shown in Fig. 3 is substantially that shown in Fig. 2, but with 13 in. chain support and canopy.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 5.

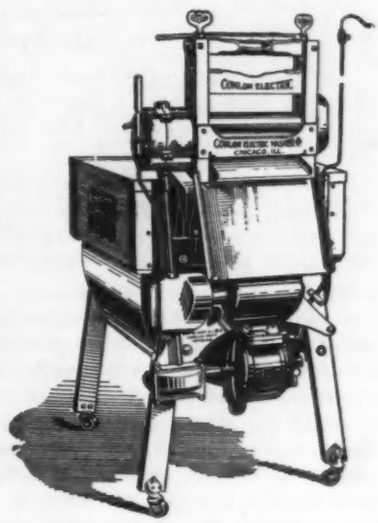
Fig. 4.

Other designs ready for the trade include an indirect unit with a fluted enameled steel reflector which distributes the light in useful directions without being intercepted by the globe. This eliminates approximately 12 per cent of bulb absorption, and avoids shadows generally caused by suspension chains (Fig. 4); and a 13 and 15 in. enameled steel reflector with ventilated hood attached before enameling (Fig. 5). A number of mogul base sockets have also been provided.

All of these fixtures are equipped with the Benjamin lamp grip for preventing the loosening and falling of lamps.

A FEATURE WASHING MACHINE.

An electric washer must be safe—"Fool Proof." In the Conlon Electric Washer here illustrated every piece of mechanism down to the smallest gear is encased and located in space which could not otherwise be used. In this way the operator does not come into contact with any of the moving parts. It is simple in operation, reliable and sanitary. The body is made of the best galvanized steel or copper as desired. The metal extends to the top of the machine, leaving no crevices or ledges on the inside to collect or absorb dirty water and soap. It is equipped with a guaranteed motor especially designed for washing machine use.



View Showing Special Features.

An alliance has been formed between the Conlon Washer Machine Company of Chicago and the Western Electric Company. Under the arrangements, the entire line will be marketed by the Western Electric Company under the trade name of the "Western Elecric-Conlon." This selling arrangements involves no changes in the manufactory. Ample stocks will be carried at each of the twenty-eight Western Electric distributing houses located at shipping centers throughout the United States.

Holabird-Reynolds Electric Company of Los Angeles are the exclusive representatives of the Conlon Electric Washer Company for Southern California.

The Conlon washer is well known to the electrical trade in general and is looked upon with particular favor by the central stations.

NEW PUBLICATIONS.

Regulation of Public Service Companies in Great Britain is the subject of a 231 page report of R. W. Whitten, published as a reprint of appendix G of the annual report of the Public Service Commission for the first district of New York. Dr. Whitten treats phases of the subject that offer suggestions for the solution of the American problem. Much space is devoted to the sliding scale system of rates and to the "merit rating method" by which companies are rated on the basis of comparative efficiency in serving the public and allowed to earn dividends varying with such efficiency.

NEWS NOTES

INCORPORATIONS.

BAKERSFIELD, CAL.—Midway Gas Company, $3,000,000, by C. P. Ellis, R. Girkin, K. Moore, R. Berliner, et al.

RENO, NEV.—Nevada Interurban Telephone Company, $50,000 shares, $1 each, by O. C. Bates, A. G. Burton, et al.

MESA, ARIZ.—Articles of incorporation of the Phoenix Machine & Cold Storage Company have been filed by Hos. Thalheimer, P. T. Hurley, S. J. Tribolet, Meizzer Bros. Co., Alex Rhienstein & Co., W. C. Dawes, Wakelin Grocery Co., et al., with a capital stock of $50,000. The company proposes to deal in ice refrigerating machinery, supplies and stores, goods, wares and merchandise of every class; also to acquire an electric light and power plant to furnish its own power, light, etc.

ILLUMINATION.

RIALTO, CAL.—The Rialto Light, Power & Water Company has been granted a franchise to construct and operate for 50 years, an electrical pole, wire and tower system in this city.

FORNIE, B. C.—The city will install a complete tungsten street lighting system covering a circuit of 100 miles and using lamps of 100 c.p. Regulators and panel boards for the control of this series system were also included in the contract.

AUBURN, WASH.—J. L. Veach, of the firm of Veach & Abraham, and stated to be representing the Auburn Gas Company, has applied for a 25-year franchise to operate mains through the city.

LOS ANGELES, CAL.—The city council has ordered necessary lighting posts and appliances to be installed, and furnishing of electric current for lighting same, of Short Line Villa tract in Los Angeles city.

GLENDALE, ARIZ.—The city council has authorized City Attorney Frank Lyman to prepare an ordinance authorizing an issue of $4000, 20 year bonds to be sold as needed for future construction of the electric light plant.

HUNTINGTON PARK, CAL.—The Western Construction Company of Los Angeles has been awarded the contract for wiring of Huntington Park's lighting system. The price was $3174.77, this includes wires and work necessary, with exception of iron posts, which are to be secured by the city under another bid.

SEATTLE, WASH.—In denying the petition of Albert Chandler for an injunction restraining the city from issuing $400,000 worth of Cedar river dam bonds and $400,000 in bonds for an emergency steam plant for the city light and power service, Judge R. B. Albertson confirmed the city's right to engage in supplying electric power as a by product of the city light plant.

VANCOUVER, B. C.—The installation of ornamental lights on Seymour street from Robson to Cordova has been recommended by the civic fire and police committee. The light standards would cost $12,560, according to an estimate of City Electrician Fletcher and would cost $3625 a year to maintain. The Georgia street standards would cost $32,784 to install and $9260 to maintain for a year.

PORTLAND, ORE.—Under protest the Portland Gas & Coke Company filed with City Treasurer Adams a statement of its gross earnings for 1913, which total $1,222,883. This statement is required by an initiative ordinance passed by the voters of 1911, to the effect that electric light and power and gas companies operating in this city under a franchise shall pay to the city annually 3 per cent of their gross earnings. The company has refused to remit to the city the 3 per cent gross tax until the validity of the ordinance is settled in the supreme court, to which the case has been appealed.

OGDEN, UTAH.—Committees from the Weber Club of this city are working actively with the property owners on Twenty-fourth street between Washington and Wall avenues for the purpose of securing their subscription to a special lighting system which it is proposed to install on that street. The Weber Club has entered into an arrangement with the Ogden Rapid Transit Company, the Utah Power & Light Company, and the city, whereby the transit company will furnish the trolley poles and the property owners will pay for the installation of a special street lighting system thereon, using luminous arc lamps, and the city will pay for the cost of the lighting after the system is completed.

LEHI, UTAH.—The city council have granted a fifty year franchise to C. W. Earl of Salt Lake City to construct, maintain and operate in Lehi City an electric distributing system for the purpose of supplying the city with electrical energy for lighting, heating and power purposes. The franchise provides for the following maximum rates:

Municipal street lighting by arc lamps	$3.75 per arc per mo.
Arc Lighting to private parties:	
For all night service	$3.75 per arc per mo.
For midnight service	2.00 per arc per mo.
Incandescent lighting	.08 per kw.-hr.
Minimum charge	1.00

The city retains the right to purchase the plant after ten years, by appraisement, if a satisfactory price cannot be agreed upon.

SAN FRANCISCO, CAL.—The state supreme court was asked for a rehearing of the Oro electric case in a petition filed by the state railroad commission, the Pacific Gas & Electric Company and the Southern California Edison Company. The supreme court in a decision several weeks ago denied to the commission the power to protect from competition a public service corporation subject to its regulations. The petition is remarkable because of the conjunction of interests that find themselves agreed to fight for more power for the railroad commission. "We take the position that if rates are to be cut down by the railroad commission and regulation carried to the point of fixing a certain rate of revenue, then the regulated companies must be protected in their field from competition," said Charles P. Cutten, attorney for the Pacific Gas & Electric Company

TRANSMISSION.

PHILLIPSBURG, MONT.—The Roya Basin Mining Company has decided to erect an electric power plant on Flint Creek, a short distance below the town of Maxville.

TUCSON, ARIZ.—Work on the construction of a power line through the Rillito River section will be started in a short time by the Tucson, Gas, Electric Light & Power Company, power to be used by ranchers for pumping purposes.

CANYON CITY, ORE.—David A. McKeown of Prairie City has filed with State Engineer Lewis an application for a permit to appropriate additional water from Strawberry Creek. He proposes to enlarge his present appropriation and develop additional power to the extent of 1527 h.p. The application provides for 15 cu. ft. of water per second, with a fall of 790 ft.

LAKEVIEW, ORE.—C. H. McKendree returned from San Francisco recently, where he went to complete filings on the

water rights of the Fall River power project, which he has been working on for some time. Mr. McKendree now has established prior rights to the project for the next 12 months, which, he thinks, will give ample time to complete arrangements for financing its construction.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has purchased the property adjoining its general office building on West Temple street, the consideration being stated at $66,000. The property has a frontage of 82 ft. on West Temple, and a depth of 165 ft. The property occupied by the present general office of the company has approximately the same frontage and depth. While it is stated by the officers of the company that no improvements are expected to be made on this property in the immediate future, it is generally supposed that it was acquired for the purpose of enlarging its general offices at some time in the future to take care of the rapidly growing business.

LOS ANGELES, CAL.—The legality of the proceedings authorizing the submitting of the proposed $6,500,000 bond issue for acquiring or constructing electric works and distributing system having been questioned by attorneys and others, the city council has authorized City Attorney Stephens to employ Dillon, Thomson & Clay, bond attorneys of New York, to investigate and pass upon the validity of the council resolution and of the bonds, if carried. The proceedings have been attacked on the ground that they do not sufficiently specify for what purpose the money is to be used. Aside from the question of legality, many taxpayers object to the concealment of the true situation with reference to the manner in which the proceeds of the bonds could be spent. It is pointed out that if the bonds are voted and sold the city council could spend $6,500,000 for the acquisition or construction of a distributing system without spending any of the money on the completion of the power works and the taxpayers would have little, if any, remedy.

TRANSPORTATION.

PORT ANGELES, WASH.—An ordinance has been passed granting to the Seattle, Port Angeles & Lake Crescent Railway authority to construct and operate a railway over certain streets and alleys in Port Angeles.

LOS ANGELES, CAL.—The board of public utilities has adopted a resolution directing the Los Angeles Railway to complete its line on Vernon avenue, and to install an interlocking apparatus at Long Beach avenue crossing the Pacific Electric.

SAN FRANCISCO, CAL.—The United Railroads began last Friday to operate the new extension of the Polk and Larkin streets line near the Exposition grounds. Hitherto the terminus was at Lombard street. It has now been placed at Bay street.

GLOBE, ARIZ.—An ordinance granting to the Globe & Miami Traction Company, a franchise to build and operate a street railway upon certain streets in Globe, will be submitted to the voters of the city at the general election, to be held May 25th.

SAN FRANCISCO, CAL.—The revenues of the municipal street car system will be increased this month by $1000, which is the first installment on its advertising contract. A New York firm agreed to pay the city $108 a car per year for the advertising space.

SAN DIEGO, CAL.—The city council has granted the applications of the San Diego Electric Railway Company for the sale of franchises for extensions on F and Laurel streets, and for permission to absorb the Point Loma Railway Company. The F and Laurel street franchises will be advertised for sale, bids to be opened June 1.

SAN FRANCISCO, CAL.—The Civil Service Commission and Superintendent Cashin of the Municipal Railway are conferring in relation to the examination which is to be held this month for platform men for the new railway lines that the city is building. Several hundred conductors and motormen will be required.

SALT LAKE CITY, UTAH.—R. S. Campbell has presented an application to the city commission for a franchise to construct and lay conduits throughout the commercial district for a heating and power distribution plant and system. Mr. Campbell states that he believes a central heating plant will do much toward solving the smoke problem which has become so serious in this city during the last few years, and claims that he and his associates will incorporate a company to be known as "The Citizen's Public Utility Company" to install and operate the system.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company has material on the ground for a power line down the Imperial Valley as far as El Centro, and the work is expected to begin at once. The power comes from Inyo county to San Bernardino, a distance of 586 miles. This development of electric power is creating a new way of locomotion in the state in the trackless trolley. One is planned from a station in the Cajon Pass to Big Pines resort, twelve miles up on the slopes of Mt. San Antonio. This is a popular summer resort, and the line is expected to be ready for service during the summer season.

SAN FRANCISCO, CAL.—As the result of a request from the public utilities committee that the street railway service be improved on Fillmore street for the accommodation of the crowds going to the Exposition, a plan has been developed by General Manager Black of the United Railroads for lowering the heavy Fillmore street electric cars down the steep incline. Black states that by increasing the size and strength of the present cable appliances on the Fillmore street grade the big cars can be lowered down the two blocks from Broadway to Green street. From Green to Filbert street, however, he says that there would have to be a trestle over Union street. The plan will be submitted to the public utilities committee. This arrangement would make transferring from Union to Fillmore street inconvenient, but Black says in this regard that as soon as the city's Van Ness avenue line is in operation that transferring at this point will be discontinued. He claims that the United Railroads is carrying passengers between the Union street and Geary street lines free of charge and that it is costing the company between $5000 and $7000 a month.

TELEPHONE AND TELEGRAPH.

PORT ANGELES, WASH.—A telephone franchise has been granted to C. J. Farmer.

HOUSE, N. M.—Citizens of House are considering the question of getting connection with the telephone line now being built to many parts of Quay county.

EUGENE, ORE.—F. H. Tivey, Emmerson Eichler and Clude Mitchell, farmers, have applied to the county court for a franchise for a pole line from the city limits along the county road to their farms.

ALAMEDA, CAL.—The city council has decided to offer the Pacific Telephone & Telegraph Company a 30 year franchise conditioned on payment to the city of 2 per cent of the gross receipts and the furnishing of 40 free telephones.

BERKELEY, CAL.—Pending disposition in the supreme court of the suit filed by the city of Berkeley against the

Pacific Telephone & Telegraph Company, seeking the dissolution of the merger of that corporation and the Home Telephone Company, officials of the former company have submitted a proposiion in which they agree to pay to the college city 2 per cent of the gross earnings each year in Berkeley until the expiration of the old Pacific States franchise, four years hence. The proposition, which is identical to the one which Oakland accepted in settlement of its suit, has been taken under advisement by the city council. Berkeley lost its suit in the superior court several months ago and appealed.

LOS ANGELES, CAL.—The city will be engaged in a legal test with the Pacific and Home Telephone companies, because of the action of the board of public utilities commission, in rate fixing, should the city council sustain its action. The commission decided that the telephone rates for the next fiscal year shall remain the same as those now in effect. It was written into the record that this will provide the companies not more than 3.4 per cent on their investment, which the companies consider confiscatory. It was shown in the hearing that even upon the board's own figures of depreciated valuations the rates are too low to give an adequate return on the investment, but Commissioner Wirsching was determined that there should be no increase in rates. President Wright declared several times during these sessions that a fair rate should be allowed, but he explained that there were only two members of the commission in the city and that the law is imperative, requiring the fixing of rates before the first of May. As his brother commissioner would not agree to any increase, the only alternative was a deadlock or to adopt a resolution fixing the present rates. This will throw the subject before the city council.

WATERWORKS.

PENDLETON, ORE.—The people of Pendleton have voted to bond the city for an additional $40,000 to complete the gravity water system.

PRINEVILLE, ORE.—Henry Cram has been granted a franchise to install a new water system in Prineville. There are 22 springs on the Cram ranch and it is proposed to build a reservoir 200 ft. above the city.

ASHLAND, ORE.—At a recent meeting of the commercial club it was determined to ask the city to vote $175,000 in bonds to be used in piping the water from the mineral springs to the city, placing drinknig pavilions and improving city parks, etc.

BRAWLEY, CAL.—The board of trustees has determined that public interest demands the acquisition and construction of municipal water works. The estimated cost is $35,000. An election will be held in the near future to vote bonds in that amount.

UPLANDS, CAL.—The Citizens Land & Water Company is preparing to expend $10,000 for the improvement of its water service. Plans include a new 800,000 gallon reservoir to be built between Fifteenth and Sixteenth streets, a new 8 inch pipe line to be laid to the city system proper.

MILWAUKEE, ORE.—The council has instructed the city engineer to survey route and ascertain the cost of a pipe line to connect with the Bull Run water system of Portland. The action was taken to ascertain if the $20,000 water bond issue would cover the cost of the pipe line and a municipal plant.

SAN RAFAEL, CAL.—At a meeting of the water directors the Marin Water & Power Company submitted a report of the J. G. White Company as to the physical value of its plant at $2,044,801. This does not include good will, franchises, etc. The financial feasibility committee in its report of the probable cost of land and water plants and Alpine dam system placed it at $3,000,000, divided as follows: Marin Water Company plant, $900,000; North Coast Company, $200,000; Howard Shafter property, $150,000; cost of Alpine dam, $1,300,000; interest on bond during construction, $200,000; additions to system, $200,000.

BUTTE, MONT.—The Butte Water Company has started work on improvements which will cost approximately $300,000. The plans include a new pipe line from the Basin Creek reservoir to Butte, installation of a big electric pump at the Big Hole civic station and replacement of the 6 inch main on Arizona street with a 10 inch pipe line.

ESCONDIDO, CAL.—Directors of the Escondido Mutual Water Company have passed resolutions declaring intention to carry out plans, by raising the dam and otherwise improving the water system and by developing water power by installing hydroelectric power plants. A bonded indebtedness in the sum of $200,000 will be created to carry out the plans.

FULLERTON, CAL.—Application for permission to construct a reservoir and conduit for conserving the waters of Boulder Creek in San Diego county, for irrigation and power purposes has been made by James A. Murray and Ed Fletcher. The proposed dam will be 40 ft. high, and the conduit 4 miles long. The cost of the plant is estimated at $274,000. The reservoir is designed for a capacity of 2,200,000 cu. ft. of water.

OREGON CITY, ORE.—The committee appointed to netiate with West Linn for the purpose of devising a means of securing a pure water supply recommend that the two cities proceed immediately to obtain water rights and make arrangements for securing the supply. Oregon City is to pay two-thirds of the cost and West Linn one-third, and also that a commission of six members from both cities be authorized to construct the complete system.

OAKLAND, CAL.—The supervisors have taken the legal steps which makes Tuesday, June 2, the date on which the people of the seven east bay municipalities will vote on the question of forming a metropolitan water district. This action makes the option given to the communities interested by F. C. Havens, whereby the Peoples Water Company may be purchased by the district at a price to be named by the state railroad commission a binding one.

RENO, NEV.—The proposition of H. G. Comstock to construct a city water supply which was presented to the council several months ago, came up last week, but no decisive action resulted, the proposal being referred to the committee of the whole for further report. Comstock, in his proposition, agrees to furnish water from a series of wells to be sunk in the vcinity of Laughton's Springs. A complete pumping plant will be installed within a brick, fireproof building and pipe line laid. The plant will have a capacity of supplying a city of 25,000 population. Six different plans were contained in the proposal, and call for a cost of $1,250,000, $775,000, $875,000, $750,000, $825,000 and $850,000, with corresponding rates of interest. Payments are divided in three parts.

ERRATA NEWS NOTE.

The news note on page 371 of the Journal of April 25, 1914, regarding the valuation of the North Yakima gas plant, was in error. The Public Service Commission of Washington has not placed a value on the North Yakima gas plant of the Pacific Power & Light Company, and this report was evidently based upon a report made to the commission by Chief Engineer F. S. Burroughs, in the course of which he stated that the cost of reproducing the North Yakima plant would be $234,093, the depreciated value being $201,748, and the actual cash invested $198,822.